

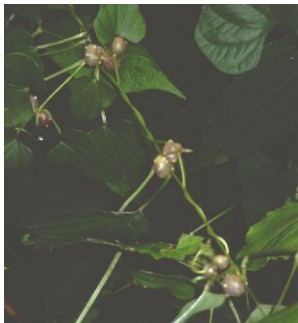
Chinese Yam (*Dioscorea batatas*) Project Update

October 31, 2000

Background

Chinese yam (*Dioscorea batatas*), native to Asia, is an herbaceous perennial vine presumably introduced historically into the park for both medicinal and ornamental uses at homesites. Recently, park managers suspect that Chinese yam is rapidly spreading from these original sites along trails and river corridors and also from disturbed sites where soil or gravel is brought from a contaminated source. A survey conducted in 1987-1988 documented 125 locations in the park and estimated that the vines covered approximately 15,301 square meters (roughly 1% of the Park's total area) and described the species as 'rapidly expanding and severely impacting various habitats' (Clements, et. al., 1989). A 1993 follow-up study at these sites estimated a 10% rate of expansion (Woodcock, 1993).

Chinese yam is considered to be highly invasive pest throughout its expanding range due to its rapid growth and prolific reproduction. Vines growing vertically in trees can reach up to 60 feet, while horizontal vines can form a dense ground cover in disturbed areas displacing native vegetation. Little is known about the species' reproductive and dispersal capacities in natural areas. While some open-grown vines produce a small spikelet of white flowers in mid-summer, it is unknown whether viable seeds develop within its current range. Instead, the species reproduces asexually via small potato-like structures called bulbils. A single vine can produce hundreds of bulbils that grow in clusters near the leaf axils. These bulbils fall and germinate readily - some after only two weeks of development.



Aerial tubers. July 2000.



Vine with tubers. July 2000.

In order to develop an integrated pest management plan, rank invasive capacity, and devise control strategies, we initiated field studies in the spring of 2000. Two weed scientists at the University of Tennessee, Dr. Darren Robinson and Dr. Tom Mueller, partnered with us providing advice and assistance as needed. We established natural history plots at six locations throughout the park to address questions such as emergence and dormancy dates, growth rates, reproductive capacity, and site characteristics. Two field experiments involving both mechanical and herbicide treatments were conducted to evaluate efficiency, timing, and level of control. Finally, we conducted an herbicide screening study in our shadehouse on potted plants to evaluate the efficiency of three approved herbicides.

Below an update on our progress follows:

Natural History Update:

At six locations throughout the park, one 3.3 X 3.3 m plot was established. Every 14 days, we visited these plots and collected the following data: % yam cover; stem height, leaf dimensions, # of leaflets of all yam within 1 X 1 m sampling frame; and presence of flowers or aerial tubers

Every 30 days, 10-15 individual plants were excavated and measured. We selected plants from a gradient of sizes present at each site ranging from the smallest seedlings to the largest vines. The plants became dormant throughout the park beginning around September 11 at some of the early plots and by October 16 at the later plots.



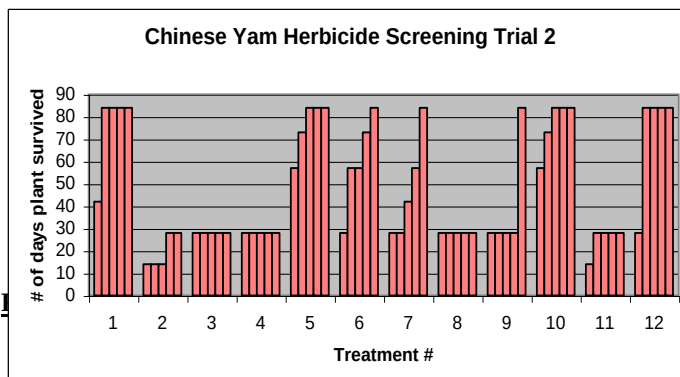
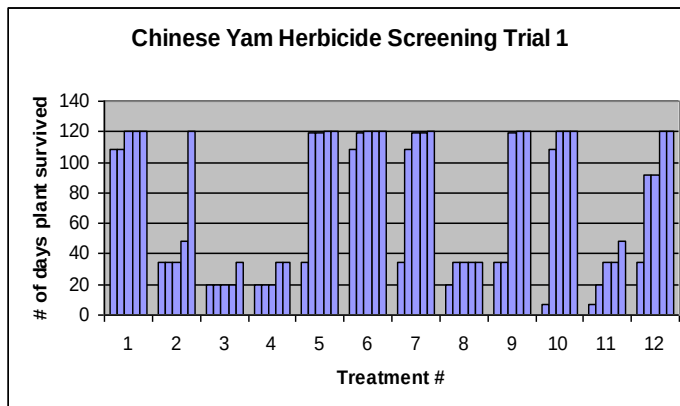
Typical root of a larger vines in August.



One of the few plants that produced a flowering stalk (July).

Herbicide Screening Update:

We screened the following different herbicide mixtures to evaluate the most effective control for Chinese yam. Darren Robinson from the University of Tennessee will be completing the data analysis. The following graphs quickly illustrate the effectiveness of several treatments. In general, the Accord treatments effectively killed the yam while the Garlon and Transline treatments had variable results.



Treatments

1. Untreated Control
2. ACCORD at 2% plus surfactant
3. ACCORD at 5 % plus surfactant
4. ACCORD at 10% plus surfactant
5. TRANSLINE 4 at 1 qt. per 100 gallons = 9.46 mls/gallon
6. TRANSLINE 4 at 3 qt. per 100 gallons = 28.39 mls/gallon
7. GARLON 4 at 1 qt per 100 gallons = 9.46 mls/ gallon
8. GARLON 4 at 4 qt per 100 gallons = 37.85 mls/gallon
9. a. TRANSLINE 4 at 1 qt. per 100 gallons = 9.46 mls/gallon
b. GARLON 4 at 1 qt per 100 gallons = 9.46 mls/ gallon
10. a. TRANSLINE 4 at 1 qt. per 100 gallons = 9.46 mls/gallon
b. GARLON 4 at 4 qt per 100 gallons = 37.85 mls/gallon
11. a. TRANSLINE 4 at 3 qt. per 100 gallons = 28.39 mls/gallon
b. GARLON 4 at 1 qt per 100 gallons = 9.46 mls/ gallon
12. a. TRANSLINE 4 at 3 qt. per 100 gallons = 28.39 mls/gallon
b. GARLON 4 at 4 qt per 100 gallons = 37.85 mls/gallon

Herbicide Timing Study:

We established 32 plots (3.3 m X 3.3 m) at one site and randomly assigned one of the following treatments to each of the individual plots: herbicide application at emergence; at flower; prior to dormancy; at emergence and at flower; at emergence and prior to dormancy; at flower and prior to dormancy; at emergence, at flower, and prior to dormancy; and control. Each treatment had 4 repetitions.

Mechanical Treatment and Treatment Timing Study:

We established 40 plots (3.3 m X 3.3 m) at one site and randomly assigned one of the following treatments to each of the individual plots: hand weeding at emergence; hand weeding at flower; hand weeding prior to dormancy; clipping at emergence; clipping at flower; clipping prior to dormancy; herbicide application at emergence; herbicide application at flower; herbicide application prior to dormancy; and control. Again, each treatment had 4 repetitions.

We collected the following data from each plot every 30 days: % yam cover; average stem height; average # of leaflets; yam stem count within 1 X 1m sampling frame; % injury; stem height, leaf dimensions, # of leaflets of all yam within 0.25 X 0.25 m sampling frame (earlier in the season, these data were collected from all yam within 1 X 1 m sampling frame); and presence of flowers or aerial tubers

At the Mechanical Treatment Site, we also collected treatment information such as length of time to complete treatment and number of times during hand weeding that the root was successfully pulled. This additional information will help us better evaluate the efficiency of the treatment method.

We have just completed the final, pre-dormancy treatment. Visually, it appeared that while the Accord treatments killed yam effectively during the mid-season treatment, the damage to non-targets was likely unacceptable. Yam in the plots treated just after emergence seemed to recover, however, the non-target vegetation was either killed or suppressed. Unfortunately, we were not able to collect non-target data this season, but hope to next year.

Please see the photographs below.



Chinese Yam in a Control Plot.



Chinese Yam in a Treatment Plot (2% Accord).

These photos illustrate the difficulty of treating yam without harming non-target vegetation. The treatment killed non-target vegetation (although, much of the non-targets in these plots is also exotic), while some of the yam remained resistant.



Treated plants became deformed and discolored later sprouting new leaves.



Treatment plots are in front of the control plots in the distance. Again, the effect of the herbicide treatment on non-target vegetation is likely unacceptable.

Future Plans:

After the completion of our data entry, we will be working with Darren Robinson to analyze our data. We will use this information to better plan for next year in which we anticipate building on the work completed. Tom Mueller has written a grant proposal which will hopefully fund a graduate student to do more extensive study at the experimental sites established this year and also additional sites throughout the park. The regrowth of both target and non-target species next season in the plots at our experimental treatment sites will provide key information we need in order to evaluate the effectiveness of the treatments.

In addition to our partners at the University of Tennessee, Kristine Johnson and Dana Soehn have joined a Chinese Yam Task Force led by biologists with the Illinois Department of Natural Resources. As a group, we hope to share information from our respective studies and develop a control plan for this species.

December

Finish data entry

January and February

Complete data analysis

Plan for next year

March

Write progress report

April - October

Collect field data

References:

Clements,R.K.; Clebsch,E.E.C.; Wofford,B.E. 1989. "Survey and Documentation of Exotic Plants in Great Smoky Mountains National Park". GRSM Sub-agreement N0. CA-5460-5-8004, unpublished.

Woodcock, P.J. 1993. "The spread of Chinese Yam in the Great Smoky Mountains National Park"
Unpublished report, University of Tennessee, Knoxville, TN